

STATE WATER RESOURCES CONTROL BOARD
DIVISION OF WATER RIGHTS

Preliminary Investigation
Pursuant to Petition for Adjudication
Little Chico Creek in Butte County

This investigation was conducted and
report prepared under the direction of

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LITTLE CHICO CREEK

PRELIMINARY INVESTIGATION

Section 2525 of the California Water Code requires the State Water Resources Control Board (Board), upon receipt of a petition requesting determination of the rights of various claimants to the waters of a stream system, to investigate and determine if the facts and conditions are such that the public interest and necessity will be served by determination of the water rights involved.

The staff of the Board, pursuant to a petition, conducted an investigation to determine public interest and necessity for a statutory adjudication of water rights in the Little Chico Creek watershed in Butte County. This report presents the findings of that investigation.

Introduction

On March 21, 1980, a petition for adjudication of the water rights to Little Chico Creek was filed with the Board. A letter of transmittal signed by Gary A. Incaudo accompanying the petition states:

"Since 1972, residents have expressed concern about the development of property on Little Chico Creek, the indiscriminate and often illegal appropriation of its water, and the resulting detrimental effects on water quality, aquatic life, foliage, and well water supply. We believe that the public interest would be best served by a prompt investigation of water use on Little Chico Creek before irreparable harm to this natural resource occurs."

The petition was signed by or on behalf of the following:

Donald F. Richey	Jean W. Whitney
Deane T. Conklin	Bruce & Pat Burke
George A. Hyde	James P. Remillard
Marvin A. Crites	Rozlyn Susanne Alexander
Gary A. Incaudo	John L. Brouillard
Robert E. Reagan	Mary Richey
Gerald T. Telander	Bill & Sally S. Chandler
Tom W. Clinton	William F. & Joan T. Derr
Lee & Betty Lowe	Marjorie L. Wooton
John & June Boyer	Donald M. Wooton
Henry & Doris Peterson	Mr. & Mrs. Gary E. Wallace
Justin & Nova Smith	Mr. & Mrs. Fred W. Hignell III
Joanne Schooling	Janet & S. Simpson
Shirley Thompson	Sharon Castillo
John W. Turner	Joseph R. Castillo
Mary Turner	Eva A. Incaudo
William Whitney	

The petitioners represent that:

1. They are claimants to or use water of the Little Chico Creek stream system;
2. "There are various claimants to waters and the use of water of said stream system and to rights in and to the waters thereof"; and
3. The public interest and necessity will be served by a determination of water rights in the stream system.

Scope of Investigation

The preliminary investigation was conducted by James Haupt, Whalen Toy and Bruce Wormald. Names and addresses of property owners in the watershed were obtained from Butte County Assessor records. One hundred forty-eight property owners in the Little Chico Creek watershed were notified by mail of the preliminary investigation. Aerial photos taken in 1979 showing recent land use and irrigated lands were obtained with the assistance of the Butte County Assessor's office to aid in this investigation.

The investigation revealed that the concerns expressed by the petitioners are limited to that portion of the watershed east and north of State Highway 99. The investigation was accordingly confined to that area. Water users, including some of the petitioners, were interviewed and their water diversions and use were inspected. Diversions under appropriation of water initiated since 1914 by application were observed to determine compliance with Board prescribed license and permit terms. No violations were observed. Available hydrologic data, together with streamflow observations, were reviewed to assess the available water supply in the stream system. An investigation and report of the geology and groundwater hydrology was made (Attachment A).

Description of the Area

The area of the Little Chico Creek watershed east of Highway 99 is about 25 square miles (Figure 1). About 12 miles below

Highway 99 the creek flows into Angel Slough, thence Butte Creek, thence Butte Slough, thence the Sacramento River. The watershed ranges in elevation from about 180 feet above sea level at Highway 99 to about 3400 feet at Forest Ranch at the headwaters.

The watershed is long (about 20 miles) and narrow (about 2 1/2 miles at its widest). Consequently, there are no significant tributaries to Little Chico Creek -- only minor unnamed streams. Little Chico Creek is an ephemeral stream that frequently stops flowing in July, August, and September (Table 1). Flow in Little Chico Creek has been measured since February 1959 by the Department of Water Resources (DWR) at a station in the NE 1/4 of Section 29, T22N, R2E, MDB&M.* The 21-year monthly mean flow ranges from a high of about 99 cfs in January to a low of 0.2 cfs in August (Figure 2). The creek may be dry at times at the gaging station. However, according to residents in the area, much of the immediate two-mile upstream reach could have flowing water. The occurrence of flowing water at those times depends on the stream bottom configuration and alluvial deposition. Long-time residents are quoted as saying that the creek historically flowed year-round before upstream developments such as storage impoundments.

*Little Chico Creek flow data are reported in the DWR Bulletins 23 and 130 series. Because the Bulletin 130 series stops with Bulletin 130-75, data later than the 1974-75 water year were provided by DWR Sutter Maintenance Yard personnel.

Domestic water supply is generally obtained from wells. Many of the users of water from wells have protested recent water right applications on the basis of depleting groundwater supplies.

The lower reach of the watershed is formed by the Chico alluvial fan.* The land surface of the fan rises to about 300 to 350 feet above sea level. Therefore, the alluvial fan comprises but a very small part of the watershed. Moreover, the fan deposits are relatively thin and feather to nothing. In this lower area volcanic deposits of the Tuscan formation underlie the recent deposits.

A Geology and Groundwater Hydrology Study was conducted (Attachment A) that indicates that the underflow of Little Chico Creek is limited to water flowing immediately adjacent to Little Chico Creek and within the shallow recent alluvium.

Chaparral is the primary vegetative cover on the hills. Deciduous trees grow mainly along the canyon floor.

Soil cover on the valley floor in the lower reach of the watershed is gently sloping, shallow, medium-textured cobbly soils.** In the upper reach of the watershed soil cover is also shallow.

*This material is mainly from USGS Water Supply Paper 1497, "Geologic Features and Groundwater Storage Capacity of the Sacramento Valley, California."

**From the U. S. Department of Agriculture, Soil Conservation Service "Report and General Soil Map, Butte County, California."

Soil type ranges from moderately fine-textured sandy loam to gravelly, cobbly, or stony loam or clay loam.

Water Use

Water diverted directly from Little Chico Creek and its tributaries or stored in reservoirs is used for domestic and stock-watering purposes and to irrigate approximately 255 acres of vineyard, pastures and orchards.

Our investigation found that a number of domestic diverters are diverting from springs, and existing subdivisions in the upper watershed (Forest Ranch Area) are supplied entirely from wells. This information was obtained from the Butte County Land Development Agency. It appears that the eastern mesa of the watershed has an excellent groundwater supply.

The following statements and applications of water diversion and use have been filed with the Board:

Statement 9460 of Robert D. and Dora C. Smith for 10 acre-feet annually diverted at a maximum rate of 30 gallons per minute from an unnamed stream tributary to Little Chico Creek for irrigation of two acres of pasture and stockwatering year-round.

Statement 9461 of Ed Daniels for 250 gal/day from an unnamed stream tributary to Little Chico Creek for domestic and stock-watering purposes year-round.

Statement 9580 of Meline and Rabo, a partnership, for 480 acre-feet annually by a gravity direct diversion at an estimated maximum rate of 450 gpm from Little Chico Creek for domestic and stockwatering purposes year-round.

Application 26076 of Dan Hays for storage of 35 acre-feet annually from an unnamed stream tributary to Little Chico Creek for irrigation of 73 acres of grapes. Additional water to be supplied from a well. Collection season beginning November 1 and ending April 15.

Application 23084, License 10197, of John Harris for storage of 32 acre-feet annually on Little Chico Creek for recreational use. Collection season beginning November 1 and ending April 30.

Application 25554, Permit 17493, of Robert D. and Dora C. Smith for storage of one acre-foot annually on an unnamed stream tributary to Little Chico Creek for fire protection, stockwatering, recreation, domestic and irrigation of five acres. Collection season beginning November 1 and ending April 30.

Application 26071 of Lee O. Halstrom for storage of 9.2 acre-feet from an unnamed stream tributary to Little Chico Creek for recreational purposes. Collection season beginning October 1 and ending March 31.

Application 23542, Permit 16570, of James M. Cornett, et al., for storage of 15 acre-feet annually from Little Chico Creek

for domestic, recreational and stockwatering purposes.

Collection season beginning October 1 and ending April 30.

Application 26066 of Anthony Santos for storage of 15 acre-feet annually from an unnamed stream tributary to Little Chico Creek for irrigation of 20 acres of peaches, grapes and garden. Collection season beginning November 1 and ending March 30.

Application 7818, License 1731, and Application 16760, License 6269, of Wayne Robert Erickson, David Henning Erickson and Robert N. Erickson and Lana E. Erickson respectively for 12,000 gal/day year-round and 4500 gal/day from about May 1 to October 1 and throughout the remainder of the year as required from two unnamed springs tributary to Little Chico Creek for domestic, irrigation, fire protection and industrial use.

The Problem

Information from the Butte County Recorder indicates that land in the watershed is being subdivided and sold as residential lots or larger parcels. These parcels, if developed, will create a greater demand for water in this water-short area. The timing of these developments and sources of their water supply are unpredictable.

Approximately 350 acres have been cleared and planted in the last few years in vineyards. About 150 acres are irrigated from wells and/or reservoirs and the remaining 200 acres appear to have been abandoned.

According to some of the petitioners who are residents in the lower watershed (Stilson Canyon subdivision), Little Chico Creek, in recent years, has ceased to flow past their homes during the summer months. They believe that the flow in this reach was continuous in years past and the decrease in flow is caused by upstream reservoirs and direct diversion. Each home in the Stilson Canyon area is being served water from an individual well. The petitioners believe their wells are directly dependent on streamflow.

They also believe it most important for fire protection purposes to maintain a live stream for direct pumping by fire fighting equipment. The canyon is quite brushy and fire is a constant danger during the summer. The residents of Stilson Canyon also feel that a live stream greatly enhances the esthetic qualities of the canyon and is a source of enjoyment to them and their children.

Discussion

1. The subdivision of land in the Little Chico Creek watershed is not justification to adjudicate the water rights. However, the uncertainty of the future water supply of these subdivisions and the effect of the current subdivision on the depletion of Little Chico Creek is reason for concern.
2. The recent irrigation of additional acreages is from wells and/or storage reservoirs that collect winter runoff. Even so, these developments raise concern about the depletion of Little Chico Creek streamflow.

3. According to some of the petitioners, Little Chico Creek, in recent years, does not flow in the summer because of upstream impoundments and direct diversion. Board permit and license terms prohibit retention of summer flows, so upstream ponds, supposedly, should not be the problem. Nevertheless, there has been a lengthy record of complaints and Board action. Better on-the-spot control could be provided by a watermaster.

The direct diversion problem appears to be caused by the diversion of Meline and Rabo, a partnership who claims a riparian right to divert the entire low flow of the creek for domestic purposes, stockwatering and irrigation. The point of diversion is located just upstream from the Stilson Ranch subdivision. The direct diversion of Meline and Rabo, according to information in our files, has been continuous since about 1911 under claim of riparian right. Mr. Rabo testified at the hearing on Application 23542 that during the 20 years he has owned the ranch he or his partner have diverted the entire low flow of the creek into a ditch to irrigate 15 to 18 acres of olives. In most years, the creek is dried up below the diversion dam in late summer except for a few pools. During some wet years, he stated, there is some flow below his dam at all times.

The riparian doctrine provides that when the supply of water is inadequate to satisfy all the reasonable beneficial requirements of all riparian users, the supply must

be shared. In this case the use by Meline and Rabo is considered reasonable and beneficial. Therefore, under present conditions, their right would allow them to continue to divert the entire flow as long as their use continues to be reasonable and beneficial and as long as other riparian owners do not claim a beneficial use for the water.

The claimed riparian right of Meline and Rabo appears valid; the use being made of the water is beneficial; and the downstream landowners, not having developed a beneficial use or having plans to develop a beneficial use, would have difficulty in forcing a reduction in use of water by Meline and Rabo in any legal proceedings that might be initiated.

4. Based on the information in the staff Geology and Ground-water Hydrology Report of the Lower Reach of Little Chico Creek and a 1973 staff field investigation, the following is concluded:
 - (a) Current sewage disposal practices preclude the use of the underflow of Little Chico Creek for domestic human consumption as reported by the residents of Stilson Canyon.
 - (b) The underflow of Little Chico Creek is limited to water flowing immediately adjacent to Little Chico Creek and within the shallow recent alluvium. The wells located in the lower canyon of Little Chico

Creek are drawing their water from percolating groundwater in the underlying Tuscan formation. All of the well logs examined show the shallow recent alluvium being sealed off.

Also, a local well driller in Chico, who drilled wells in the subdivision, stated in 1973 that the wells he drilled are all from about 180 feet to 220 feet deep; static water levels are about 60 to 80 feet below ground surface, many feet lower than the creek water level; the material is cemented gravel alternating with lava and sandstone; all material encountered was quite tight; the driller did not believe the wells extract water from the supporting underflow of the creek; and he did not believe the water supply to the wells is inadequate.

5. The historical streamflow measurements (see Table 1) indicate that the flows in late summer are normally very low. The 21-year monthly mean low is 0.2 cubic feet per second. The gage is downstream from the Meline and Rabo diversion which depletes the stream as described in Discussion, item 3. As the number of residences of Little Chico Creek increases, the solution for both adequate water supply and fire protection may be through formation of a community water system where adequate supply and pressure could be more readily maintained from larger and deeper wells.
6. The residents of Stilson Canyon also feel that a live stream greatly enhances the esthetic qualities of the canyon.

The Board has initiated an instream Use Protection Program because of its desire to find a more satisfactory way to fulfill its responsibilities to protect the public interest when permits or orders are issued for the appropriation of water. These responsibilities are explained in the body of law which authorizes the Board to grant permits for the appropriation of water which is, by statute, the property of the people of the state. The Board is authorized to reject an application or condition permits to protect the public interest, but the Board has no jurisdiction over riparian rights unless the use is wasteful or unreasonable or unreasonable method of use or diversion is being made.

In the Soquel Creek Adjudication, a number of individuals filed proofs of claim for such uses as "aesthetic, health, security and wildlife," uses which were denied by the Board because they "do not require diversion of water from a stream system and, thus, do not provide a basis for a water right...." Also, in the same adjudication, the Department of Fish and Game submitted a brief with a recommendation of four cfs for preservation of steelhead, salmon and trout fisheries and asked that this flow be granted a priority classification correlative with other priority rights and subject to proportionate reduction in dry years. The Board rejected this recommendation, concluding that its adjudication authority is limited by law to determining "existing vested water rights" and does not extend to the

reservation of "a minimum streamflow for fish correlative or otherwise for which no water right is vested."

In another adjudication, Scott River Adjudication, the Order of Determination included provisions for minimum instream flows for fish and wildlife within the Klamath National Forest, additional instream flows to provide incremental fish flows and for recreational scenic and aesthetic purposes within the forest, and construction and operation of diversion structures to allow fish migration. It also reserves high flushing flows for fisheries. (The Forest Service filed proofs of claim based on riparian right and on the federal reservation doctrine.)

The Board staff is presently preparing recommendations for proposed Orders of Determination for the Willow Creek and Roaring Creek Adjudications. Staff proposes to recommend inclusion of the following provisions to be submitted for review in Preworkshop and Workshop Sessions.

For Willow Creek:

Rights of fifth priority dormant riparians and those of future appropriators to be subject to the maintenance of a minimum flow of 0.5 cfs in Willow Creek at the Fenders Ferry Bridge upstream of the Montgomery Creek confluence. This is to provide minimum subsistence-level fishery conditions.

For Roaring Creek:

Surplus right set forth in the order in Schedule 3, the rights of future appropriators, and those of dormant riparians, to be subject to maintenance of a minimum flow of 5 cfs in Roaring Creek at Big Bend Road Bridge. This is to provide minimum subsistence-level fishery conditions.

Conclusions

1. Subdivision of land in the Little Chico Creek watershed is not justification to adjudicate the water rights.
2. Recent irrigation of additional acreages is from wells and/or storage reservoirs that collect winter runoff.
3. Control of upstream impoundments and direct diversion may best be controlled through procedures available in the Board regulations which provide for complaint against waste and unreasonable use, and violation of permit and license terms and conditions.
4. Staff Geology and Groundwater Hydrology Report of the Lower Reach of Little Chico Creek (Attachment A) concludes that:

"The underflow of Little Chico Creek is limited to water flowing immediately adjacent to Little Chico Creek and within the shallow recent alluvium. The wells located in the lower canyon of Little Chico Creek are drawing their water from percolating groundwater in the underlying Tuscan formation. All of the well logs examined show the shallow recent alluvium being sealed off."

"Current sewage disposal practices preclude the use of the underflow of Little Chico Creek for domestic human consumption."

5. The historical streamflow measurements indicate that the flows in late summer are normally very low. The 21-year monthly mean low is 0.2 cubic feet per second.
6. The facts and conditions in the Little Chico Creek watershed are such that the public interest and necessity will not be served by a determination of the water rights.

Recommendation

Staff recommends that the Board deny the petition for an adjudication of the water rights in the Little Chico Creek watershed.

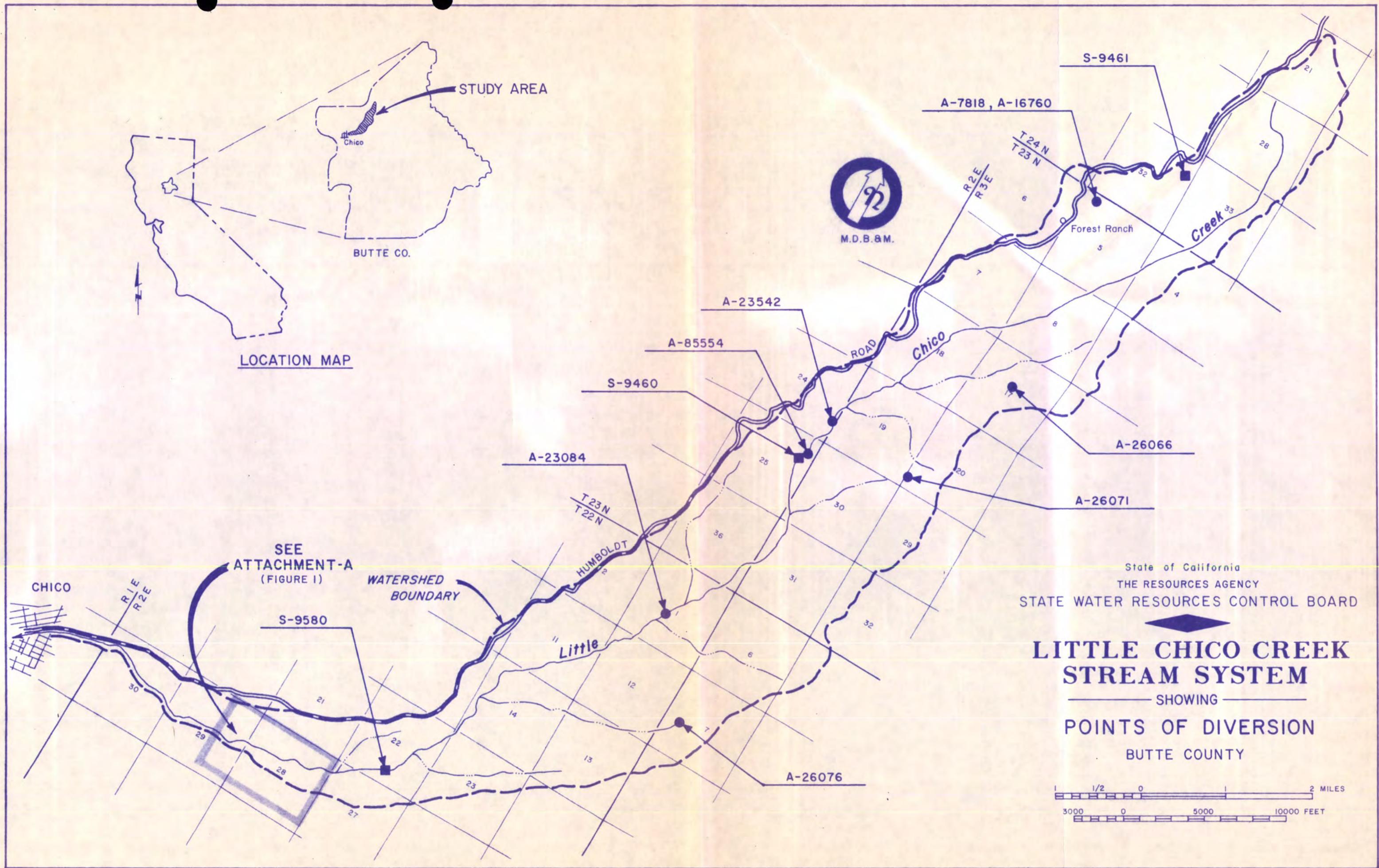


FIGURE 2

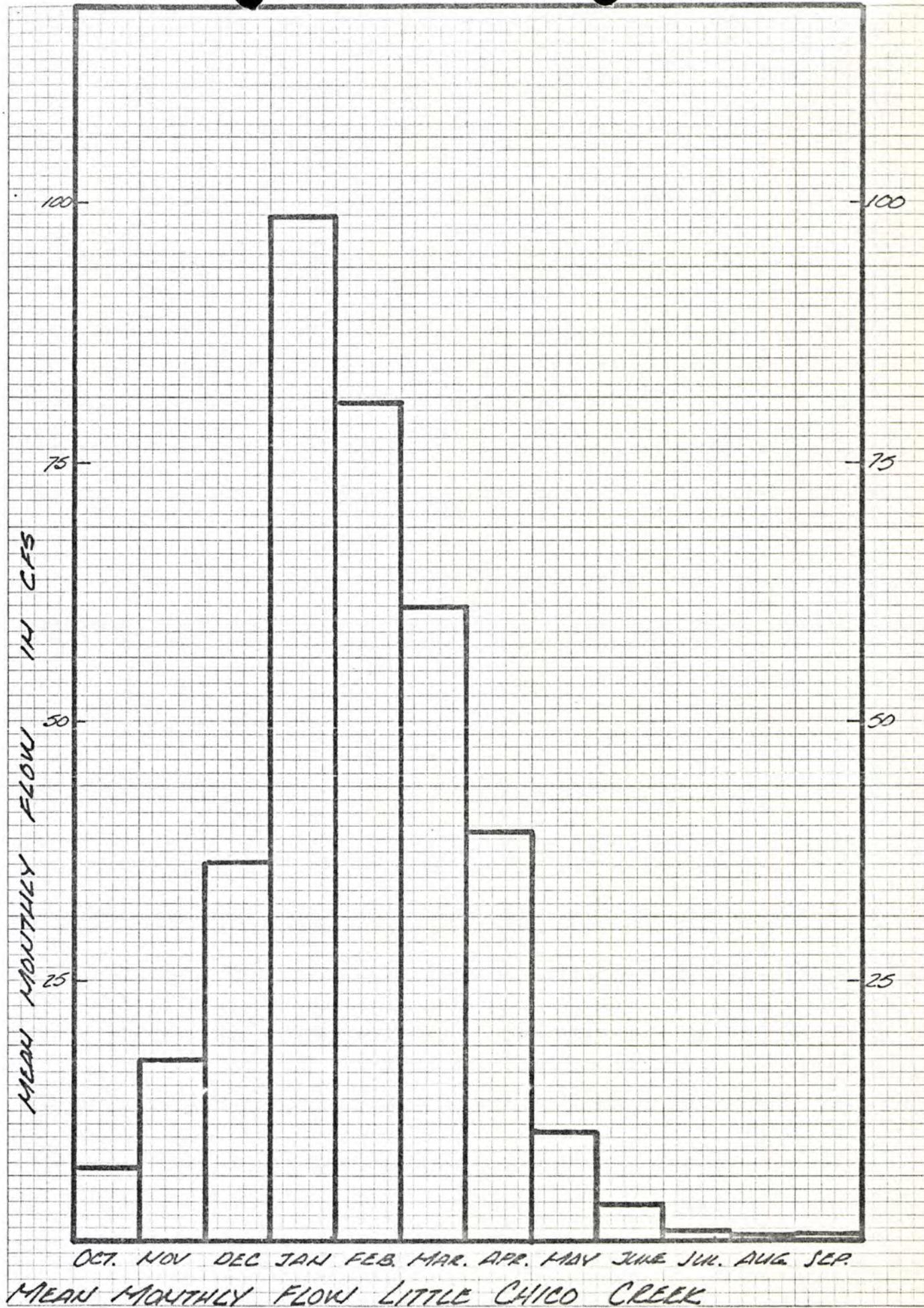


TABLE 1
LITTLE CHICO CREEK STREAMFLOW*
(FLOW IN CFS)

WATER YEAR	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.
1958-59					82.2	14.7	8.4	4.1	1.1	0	0	0.6
1959-60	0.6	0.9	1.9	18.1	65.4	46.5	9.7	8.1	2.5	0.2	0	0
1960-61	0.3	8.9	11.6	24.4	67.1	40.4	13.6	4.5	2.9	0	0	0
1961-62	0.2	2.9	24.6	20.6	160.4	74.1	12.5	4.9	2.1	0.3	0	0
1962-63	83.4	6.4	50.9	62.4	93.2	61.7	167.1	27.5	9.0	3.4	1.1	1.1
1963-64	1.5	19.7	5.7	32.3	9.0	5.6	4.8	2.3	0.6	0	0	0
1964-65	0.3	14.0	116.4	140.5	24.7	13.1	74.8	23.9	6.9	1.4	1.7	0.6
1965-66	0.7	11.2	10.6	60.8	55.4	14.9	7.7	3.3	0.9	0	0	0
1966-67	0.4	21.5	60.5	155.8	61.2	66.5	127	33.4	8.9	2.1	0.5	0
1967-68	0.9	3.5	8.4	53.6	82.9	53.7	11.8	4.6	1.7	0.2	0.2	0
1968-69	1.0	5.2	57.0	28.8	285	75.9	39.7	10.8	4.5	1.7	0	0.2
1969-70	1.2	4.1	120	299	78.0	64.0	14.5	6.8	3.2	0.5	0	0
1970-71	2.6	31.7	97.5	44.0	14.4	34.8	19.3	6.9	2.3	0.5	0	0.1
1971-72	0.7	2.4	7.8	7.8	10.6	6.6	8.8	2.5	0.6	0	0	0
1972-73	0.8	21.4	30.2	203.3	184.6	110	28.2	8.3	2.6	0.3	0	0
1973-74	2.9	170.3	118.0	173.6	60.2	243	103	14.8	7.7	1.9	0.6	0.5
1974-75	1.1	2.7	18.6	12.0	165.6	130.1	46.8	13.2	4.7	2.1	0.5	0.2
1975-76	3.7	4.7	7.0	3.6	10.7	14.1	7.6	1.1	0.3	0	0	2.3
1976-77	0.2	1.2	-	-	2.8	4.1	2.0	1.9	0.1	0	0	0.9
1977-78	0.1	3.0	21.3	177	106	147	86.8	22.5	4.9	1.9	0.1	1.1
1978-79	0.3	2.4	2.7	30.6	107	57.4	20.9	10.5	2.9	0.9	0.2	0.0
MEAN	5.2	16.9	38.5	77.4	81.8	60.9	38.8	10.3	3.4	0.8	0.2	0.4

*STATION LOCATED IN NE $\frac{1}{4}$ SECTION 29, T22N, R2E, MDB & M AND ABOVE DIVERSION DAM
500FT. SOUTH OF STILSON ROAD, 3.6 MILES EAST OF CHICO

GEOLOGY AND GROUNDWATER HYDROLOGY OF THE LOWER REACH OF LITTLE CHICO CREEK

On March 21, 1980 the Board received a petition from a number of people riparian to Little Chico Creek requesting an adjudication of the waters of Little Chico Creek. In the course of the preliminary investigation, several of these riparian owners have claimed that their wells draw from the underflow of Little Chico Creek. The purpose of this investigation of the geology and groundwater hydrology was to determine whether any of the wells belonging to petitioners and located within the drainage of Little Chico Creek actually draw water from the underflow of Little Chico Creek.

Little Chico Creek is located in Butte County in the northeastern part of the Sacramento Valley. It is a consequent stream incising the tableland that forms the foothills of the southern extension of the Cascade Range geomorphic province in California. Little Chico Creek is a tributary of the Sacramento River. The Creek flows south 10 degrees west until it emerges on the valley floor. The direction of flow then changes to south 60 degrees west, flowing through the town of Chico, following the natural slope of the valley floor to the confluence of the Creek with the Sacramento River.

This investigation was confined to the reach of Little Chico Creek commencing at the western boundary of Section 28, T22N,

R2E, MDB&M, and extending upstream for approximately 10 miles. In conducting the investigation, available geologic literature of the area was reviewed and available well logs were examined. An interview was conducted with a well driller who had drilled a number of wells in the area. Individual owners of wells were questioned and several field inspections were made.

The dominant geologic formation exposed in the area is the Tuscan formation. The Tuscan formation is principally tuff breccia, lapilli tuff, volcanic conglomerate and sandstone with lesser quantities of tuff, claystone and siltstone. Individual members are quite consistent along the strike. The lensing out of any unit is usually rather gradual. The hard indurated tuff breccia is resistant to erosional and soil forming processes. Therefore, it is the most striking rock type, forming the distinctive stepsided canyon walls characteristic of the stream channels in this area. These tuff breccias form distinctive marker beds that can be traced for several miles. They vary in thickness from 6 to 40 feet. Although not as distinctive, volcanic conglomerate and volcanic sandstone are of equal importance. They constitute 50 percent of the Tuscan formation. The conglomerates and sandstones are of sedimentary origin. They are probably derived from the tuff breccias and tuffs.

The Tuscan formation dips from 6 to 10 degrees to the south and southwest in the vicinity of the investigation and extends under

the Sacramento Valley floor. In the vicinity of Chico, the Tuscan formation is one of the principal aquifers of the Sacramento Valley groundwater basin. The volcanic conglomerates and sandstones contribute copious quantities of water to wells, but water is found at all depths in the Tuscan formation.

The indurated tuffs and tuff breccias derive their permeability from numerous cracks, crevices and fissures. This incipient fracture pattern is revealed in vegetation patterns in aerial photographs where the tuff breccias are exposed on the surface.

Upstream in Section 11, T22N, R2E, MDB&M, the base of the Tuscan formation is exposed. In this area it is separated from the underlying Chico formation by a dense black olivine basalt. The underlying Chico formation is a marine formation that also extends out under the valley floor. The Chico formation is of marine sedimentary origin, relatively impermeable and is known to produce connate saline water. It is also a source of methane in some areas.

The Tuscan formation is about 500 feet thick where its base is exposed in Section 11, T22N, R2E, MDB&M. The Tuscan formation has been considerably eroded. An overlying fanglomerate composed of detritus derived from the Tuscan formation is exposed at the edge of the valley floor.

Where Little Chico Creek emerges from its canyon onto the valley floor, a tongue of recent alluvium extends upstream approximately

two miles. At the western edge of Section 28, the western edge of the study area, this small alluvial tongue is approximately 2,000 feet wide but it rapidly necks down to 500 feet wide and is that width for most of its length. The maximum elevation difference between the thalweg of Little Chico Creek and the edge of the canyon walls is approximately 20 feet. The gradient of Little Chico Creek averages about 35 feet per mile in this area. An examination of 30 well logs drilled in Section 28 within the canyon floor indicates that the depth of recent alluvium varies from 15 to 30 feet. This was also confirmed in discussions with a local well driller who has drilled approximately 20 wells in the area. These logs indicate that bedrock (Tuscan formation) under the thalweg of Little Chico Creek does not exceed 20 feet in most cases. The alluvium consists of poorly sorted cobbles, gravel and sand capped with a soil mantle three feet thick. The material is highly permeable and transmits some underflow of Little Chico Creek.

The majority of the well logs available were for wells drilled from the period 1967 to 1973. At that time Butte County had no requirements regarding well standards. Common practice was to drive about 50 feet of casing down through the alluvium into the underlying Tuscan formation sealing off the alluvium. Water wells in the competent Tuscan formation will hold themselves open without any casing. About 20 feet of clay was used as a surface seal. The average depth of 22 wells drilled in Section 28 was 191 feet; minimum depth was 110 feet and maximum depth was 292 feet. Where water levels were reported they were recorded at

greater than 160 feet. Seven wells were drilled to 160 feet or less indicating that water is encountered at less than 160 feet.

In recent years the lower portion of Little Chico Creek has undergone subdivision and development. Most of the parcels in the area are of 3/4 acre size or larger. There is no municipal water supply or sewage disposal so those persons living in the area must supply themselves with water from wells and dispose of their sewage through septic tanks and leach fields. As development has proceeded the area has passed from a pastoral setting to a semisuburban situation. Three or four wells have failed because of pollution from nearby septic tanks (Figure 1). This confirms the highly permeable nature of the alluvium tongue described above and the underlying Tuscan formation. One well owner interviewed stated that after rainstorms and during periods of high runoff, when there was a high sediment load in Little Chico Creek, they repeatedly experienced sediment in their well water (Figure 1). However, the well driller stated that one owner of a well he had drilled had repeatedly complained of surface contamination. Therefore, the well driller conducted a dye test. Water was pooled around the collar of the well and fluorescein dye was introduced into the pool. The well was then pumped repeatedly to see if there was any surface infiltration. The results of this testing were negative indicating that degradation was not occurring from seepage around the collar, but that there may have been seepage occurring at a lower level.

Little Chico Creek; along with numerous adjacent creeks both north and south, such as Big Chico Creek, Butte Creek and Little Butte Creek; serves as the recharge area for the groundwater found in the Tuscan formation under the Sacramento Valley. Infiltration from both direct precipitation and runoff percolates into the formation either through the fracture pattern found in the tuff breccia members or through the permeable volcanic conglomerate and sandstone members. It then flows down gradient and eventually forms part of the Sacramento groundwater basin. Underflow in the tongue of shallow alluvium extending into Little Chico Creek canyon would abandon this regimen and percolate vertically into the underlying aquifers (Tuscan formation). The failure of three or four of the shallower wells and turbidity in the one well discussed above also support the evidence of downward percolation of water from Little Chico Creek. The rapid response of the one well to turbid flow conditions in Little Chico Creek is either caused by a coincident fracture pattern intercepting the well bore or improper sealing between the casing and well bore where the casing penetrates the Tuscan formation.

Conclusions

The underflow of Little Chico Creek is limited to water flowing immediately adjacent to Little Chico Creek and within the shallow recent alluvium. The wells located in the lower canyon of Little Chico Creek are drawing their water from percolating groundwater in the underlying Tuscan formation. All of the well logs examined show the shallow recent alluvium being sealed off." Current sewage disposal practices preclude the use of the underflow of Little Chico Creek for domestic human consumption.

